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1. Your reference FB3936

2. Patent application number *(The Patent Office will fill in this part)* **9825446.9** 21 NOV 1998

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

St. Brendan's Irish Cream Liqueur Co. Ltd
10 Rossdowney Road
DERRY
BT47 6NS

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation 07553647001

4. Title of the invention "A thermoreversible food product"

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

9 University Street
BELFAST
BT7 1NA

Patents ADP number *(if you know it)* 07553670001

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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Number of earlier application	Date of filing *(day / month / year)*

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11. XX/We request the grant of a patent on the basis of this application.

Signature Ciaran M Slg.nw Date 26-10-98

12. Name and daytime telephone number of person to contact in the United Kingdom: M O'Connell 01232 236000

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A THERMOREVERSIBLE FOOD PRODUCT

The present invention concerns a thermoreversible food product.

The term "thermoreversible" is intended to mean that which is convertible from a gel phase at room temperature to a liquid phase at a temperature elevated above room temperature. The term "thermoreversible" also includes the preferred term "thermo-interchangeable" as that which is convertible from a gel phase at room temperature to a liquid phase at a temperature elevated above room temperature and is re-convertible back to a gel phase when cooled to room temperature.

The food product may be, for example, a coffee liqueur product, having a base layer containing coffee and alcohol and having a top layer containing animal fat, vegetable fat or a mixture thereof. It is envisaged that the food product may be heated by means of a microwave.

In a first embodiment, the invention provides a food product having a top layer comprising less than 70% (w/w) water and an amount of at least one emulsifier and at least one thermoreversible setting agent, the emulsifier and the setting agent being sufficient to maintain the top layer in a thermoreversible gel phase at room temperature, with the proviso that the, or each, emulsifier or setting agent is not sodium caseinate.

Preferably, the thermoreversible setting agent is gelatine; and the emulsifier is selected from mono- and di-glycerides, sucrose esters; or mixtures thereof. More preferably, the top layer contains 1-1.5% (w/w) gelatine. Even more preferably, the base layer contains 2.25-2.75% (w/w) gelatine. It will be appreciated that the amount of gelatine in the top layer and/or in the base layer may be increased if it is desired to reduce the setting time at a constant ambient temperature or, alternatively, to maintain or reduce the setting time at an elevated ambient temperature.

In a conventional cream liqueur system, sodium caseinate is used as an emulsifier and as a stabiliser. However, in a microwavable food product, which is the subject of the present invention, the presence of sodium caseinate and alcohol causes skin formation when the food product is microwaved. It was, therefore, necessary to preclude the use of sodium caseinate.

It is believed that a top layer having less than 70% (w/w) water reduces hydrogen ion migration, which is accompanied by colour migration, from the base layer to the top layer, which hydrogen ion migration affects the pH of the top layer and may be accompanied by a breakdown in the stability of the top layer's emulsion, causing it to lose its thermo-reversibility.

Suitable emulsifiers do not form a skin on the top layer when the top layer is heated - it is thought that such skin

formation is related to denaturation of a proteinaceous emulsifier, so that such emulsifiers should be avoided. Suitable emulsifiers include, but are not limited to, mono- and di-glycerides of fatty acids and sucrose esters or mixtures thereof. Sucrose esters endow good stability, but their organoleptic properties need to be improved.

Preferably, the top layer contains 40-65% (w/w) water, more preferably 57-64% (w/w) water.

Advantageously, the top layer additionally comprises more than 15% (w/w) fat. More advantageously, the top layer contains 20-40% (w/w) fat. The fat can be of animal or vegetable origin, or a mixture thereof.

According to a second embodiment of the invention, there is provided a method for forming a layer of a food product comprising at least one emulsifier and at least one thermoreversible setting agent, the method comprising the steps of providing a first liquid phase at a temperature below room temperature; providing a second liquid phase comprising an amount of the at least one emulsifier and setting agent sufficient to maintain a mixture of the first and second liquid phases, when mixed, in a thermo-reversible gel phase at room temperature, with the proviso that the, or each, setting agent or emulsifier is not sodium caseinate, the second liquid phase being at a temperature elevated above room temperature; and mixing the first and second liquid phases to obtain the top layer.

It will be appreciated that, if the food product comprises a top layer and a base layer, the aforementioned method comprises the steps of providing first and second base phases; mixing the first and second base phases and allowing the thus mixed first and second base phases to set; providing first and second top phases; mixing the first and second top phases and allowing the thus mixed first and second top phases to set on the base layer.

The invention will now be described and exemplified in the following example, which is not intended to limit the scope of the invention.

Example 1

The food product in the form of an "Irish coffee" has two layers, namely a base layer and the top layer. It will, of course, be appreciated that the food product may, alternatively, be a "French Coffee" if brandy is added instead of Irish whiskey. Similarly, a "Russian Coffee" (vodka) or "Caribbean Coffee" (rum), etc., are also envisaged.

The base layer is made first and needs to set before the top layer is applied. The base layer is made by forming first and second liquid base phases, the first liquid base phase being a coffee flavoured solution and the second liquid base phase being a 7.5% (w/w or w/v) gelatine solution.

In the present example. two volumes of the first liquid base phase are mixed with one volume of the second liquid base phase, resulting in a base layer having a 2.5% (v/v) or 2.45% (w/w) gelatine concentration (see Table 1).

Table 1 shows the ingredient list for the base and top layers.

Table 1

BASE LAYER - INGREDIENT LIST			
Ingredients	**Quantity**	**Weight Equivalent (kg)**	**% (w/w)**
Water	737.89l	737.89	72.34
Sugar	153.00kg	153.00	15.00
Gelatine	25.00kg	25.00	2.45
Caramel	5.00kg	5.00	0.49
Neutral Spirit	95.67l	77.92	7.64
Whiskey	13.00l	11.56	1.13
Flavour	4.00kg	4.00	0.39
4% NaOH Solution	5.63l	5.63	0.55

TOP LAYER - INGREDIENT LIST			
Ingredients	**Quantity**	**Weight Equivalent (kg)**	**% (w/w)**
Water	511.92l	511.92	46.75
Double Cream	200.00l	196.42	17.94
Akolat (Trade Mark) B15	150.00kg	150.00	13.70
Sugar	100.00kg	100.00	9.13
Neutral Spirit	105.60l	86.01	7.85
Whiskey	14.40l	12.80	1.17
Starch	10.00kg	10.00	0.91
Tri Sodium Citrate	0.85kg	0.85	0.08
Gelatine	15.00kg	15.00	1.37
E471 Emulsifier	2.00kg	2.00	0.18
Flavour	10.00kg	10.00	0.91

The first liquid base phase is prepared by heating 30% of the water used to make the base layer to 15°C in a jacketed insulated tank equipped with a mixer and dissolving the sugar therein. The caramel, neutral spirit, whiskey and coffee extract flavours are then added and the pH is then corrected to 6-7. When fully dissolved, 25.1% of the water used to make the base layer is added as ice, thereby chilling the solution to 4°C.

The second liquid base phase is prepared by using 44.9% of the water used to make the base layer so as to make a 7.5% (w/w or w/v) gelatine solution. The water is heated to

70°C in a jacketed insulated vessel equipped with a stirrer and the gelatine powder is added under agitation. The solution is maintained at 70°C for 3 minutes, in order to ensure that the gelatine is solubilised. The mixture is then cooled, with stirring, to 35°C.

The base layer is then obtained by transferring two volumes of the first liquid base phase into the end mould, for example, a glass and, thereafter, dispensing one volume of the gelatine solution (second liquid base phase) into the mould in such a way as to ensure that the first and second liquid base phases are completely mixed. This is achieved using twin piston volumetric fillers, which are equipped with non-drip filling nozzles and individually jacketed hoppers (at 4°C and at 35°C, respectively) for the first and second liquid base phases. The second liquid base phase hopper should be a low volume tank, to ensure rapid turnover and short holding times of the second liquid base phase and its filling head, down to the filling nozzle, should be trace heated to 35°C. Both filling heads/mechanisms should be attemperated by initially re-circulating the respective first and second liquid base phases. 66.66mls of the first liquid base phase (at 4°C) and 33.33mls of the second liquid base phase (at 35°C) are mixed by simultaneously filling into a 17cl "tulip" glass with a resulting temperature, when mixed, of 16°C approximately. Filling is through twin off-centred, non-drip filling nozzles, to ensure adequate mixing.

Extensive testing of a wide variety of glass types has demonstrated that the use of a "tulip" glass is preferred for manufacturing the product and for microwaving it prior to consumption. The "tulip" type glass is the most stable on the production line, it maximises the mixing of the two phases at the fillers and shows good load-bearing characteristics for foiling. On microwaving the "tulip" glass does not develop convection currents and therefore does not display the mixing of the two layers which is characteristic of other glass types.

At the optimum temperature of 4°C for the first liquid base phase and 35°C for the second liquid base phase, the base layer sets in a period of 7-10 minutes at 10-20°C.

The 17cl glass containing the base layer at approximately 16°C is transferred to a covered, positively-pressured, first accumulation conveyer, whereupon it is retained for 20 minutes so as to ensure a firm set of the base layer.

The top layer is made in the following manner. Once again, the top layer is formed by providing, separately, first and second liquid top phases which are thereafter mixed. In the present example, four volumes of the first liquid top phase are mixed with one volume of a 7.5% (w/w or w/v) gelatine solution, resulting in a top layer containing 1.5% (v/v) or 1.37% (w/w) gelatine (see Table 1). These volumes are selected to enable the same gelatine solution (7.5% (w/w or w/v)) to be used as the second liquid base phase and as the second liquid top phase. It will be appreciated

that, if a different gelatine concentration is used as either a second liquid base or top phase, the volume dilution must be altered to achieve the desired gelatine concentration in the final base layer or top layer.

The first liquid top phase is made by heating 60.43% of the water used to make the top layer to 80°C in a jacketed insulated tank equipped with a high speed stirrer, the water being agitated vigorously. Tri-sodium citrate (sequestering agent), emulsifier (E471), starch, sugar, Akolat (Trade Mark) B15 vegetable fat, double cream, neutral spirit, whiskey and cream liqueur flavours are then added in that order. The mixture is heated to 55°C and, with vigorous stirring, the solution is maintained at 55°C for 2 minutes. The solution is then double homogenised at 4,000 psi. The first liquid top phase is then cooled in-line to 13°C and can be stored at a temperature of 13°C in a jacketed insulating tank equipped with a stirring paddle. The second liquid top phase is prepared by using 39.57% of the water used to make the top layer so as to make a 7.5% (w/w) gelatine solution, the water being heated to 70°C in a jacketed insulated vessel equipped with a stirrer and the gelatine powder being added under agitation. The solution is maintained at 70°C for 3 minutes, so as to ensure that the gelatine is fully solubilised. The mixture is then cooled, with stirring, as rapidly as is possible to 35°C.

The top layer is then obtained by mixing the first and second liquid phases thoroughly in a ratio of 4.0 parts by volume of first liquid top phase and 1.0 parts by volume of

second liquid top phase. Specifically, twin piston volumetric fillers are used, each equipped with individually jacketed hoppers (at 13°C and at 35°C, respectively) for the first and second liquid top phases. The filler is equipped with a single filling and mixing head to thoroughly mix the discharges of both pistons before their deposition in the 17cl glass which contains the set base layer. Filling volumes of 40ml and 10ml of first and second liquid top phases, respectively, are used, the filling being via a single centred non-drip filling nozzle. Once again, the second liquid top phase hopper should be a low volume tank to ensure rapid turnover and short holding times of the second liquid top phase. Its filling head, down to the mixing head, should be trace heated to 35°C. As before, both filling heads/mechanisms should be attemperated by initially re-circulating their respective products. The top layer takes 8-10 minutes to set at an ambient temperature of about 16°C. The 17cl glass containing the set base layer and the 50ml top layer is then passed to a second accumulation conveyer (covered and positively air pressurised) for a 20 minute residence time until a firm set has been achieved. The 17cl "tulip" glass containing the set base layer and the set top layer is then transferred to a rotary foiling station where a microwavable film or foil is picked from a magazine, placed on the glass rim and conduction sealed at 180°C for 1-1.5 seconds. The heated sealing head is a rubber/metal composite which is fixed on flexible mountings.

The foil is a heavy gauge aluminium without rough edges, to minimise the risk of "arcing" in the microwave. The foil underseal is specifically formulated to seal to the very small cross section of the glass rim within the time/temperature allowed. The product is then passed for packaging.

Experiments (see Table 2) show that it is possible to make a stable cream-containing top layer with a shelf life of up to 12 weeks at temperatures up to 22°C, without using sodium caseinate to stabilise the emulsion. Above 22°C or so, the food product will begin to revert back to a liquid phase.

The presence of 0.18% (w/w) E471, as emulsifier, in the top layer, yields a top layer with good organoleptic properties which does not form a skin after microwaving.

It will be appreciated that the temperature and residence times indicated herein are ambient temperature dependent and will vary depending on the actual ambient temperature experienced.

When it is desired to consume the food product, the glass containing the base layer and top layer and covered with the foil is placed in a 700W microwave oven for 1 minute to heat the top layer to approximately 52°C and the base layer to approximately 62°C. It will, of course, be appreciated that the microwave conditions will vary, depending on the make, age and wattage of the microwave oven.

The invention is not limited to the embodiment described and exemplified herein, which may be modified or varied without departing from the scope of the present invention.

able 2 **Shelf Life Data: Food Product of Example 1**

AMBIENT CONDITIONS				MICROWAVED					
k Colour	Solid	Synersis	Fractures	Base Layer Temperature	Top Layer Temper-ature	Skin Formation	Convection/ Mixing	Aged/Mousse Top Layer	Breakdown at Inter-face
Distinct white layer	Base Sharp after taste	None	None	66°C (1)	56°C (1)	None	None	Creamy consistency	None
No colour migration	Taste good but bitter	None	None	66°C (1)	48°C (1)	None	Some mixing		None
No sign of colour migration	Topping - very creamy but bitter after taste	None	None	60°C (2)	50°C (2)	None	Slight mixing but nothing significant	Not completely melted	None
No colour migration - very distinct layers	Topping - sweet/ creamy very nice mouth feel	None	None	64°C (2)	58°C (2)	Slight skinning after 5 mins	Mixing almost immediately	Not completely melted	None. Very distinct layers
Slight colour migration	Topping - taste pleasant	None	None	63°C (2)	59°C (2)	None	Some convection between the two liquids	Not completely melted	None. Very distinct layers
Slight colour migration at inter-face - not significant	Topping - excellent taste and texture	None	None	63°C (3)	64°C (3)	None	Some convection between the two liquids	Not completely melted	None. Very distinct layers
Colour migration from base to topping	Topping - pleasant	Very slight	None	59°C (2)	58°C (2)	None	Slight	Not completely melted	None. Very distinct layers

	Colour migration of topping	Topping - pleasant but bitter after taste	None	None	58°C (3)	49°C (3)	None	Slight convection between the two liquids	Not completely melted	Still stable. No breakdown
	Colour migration of topping	Topping - good taste and texture	None	None	61°C (3)	59°C (3)	None	Some convection between the two liquids	Not completely melted	None
	Colour migration	Very good taste and texture	None	None	60°C (3)	55°C (3)	None	Some convection	Not completely melted	None
0	Colour migration	Topping - good taste	Signifi-cant signs of synersis	None	60°C (3)	51°C (3)	None	Some convection between liquids	Not completely melted	None
1	Slight colour migration	Creamy smooth texture and taste	None	None	59°C (3)	43°C (3)	No immediate skinning. Slight: 7 mins	None	Not completely melted	None
2	Colour migration	Taste - a salty taste (citrate) - acceptable	None	None	60°C (3)	61°C (3)	None	Very slight convection		None
3	Colour migration	Taste - very sweet tasting	None	None	58°C (3)	53°C (3)	None	Slight mixing	Not completely melted	None

1) Microwaved for 1 minute
2) Microwaved for 1 minute 15 seconds
3) Microwaved for 1 minute 10 seconds